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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/808,714	03/14/2001	Volker Drexel	(Z) 00022 P US	5823

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EXAMINER	
JOHNSTON, PHILLIP A	

ART UNIT	PAPER NUMBER
2881	

DATE MAILED: 11/18/2002

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)
	09/808,714	DREXEL ET AL.
	Examiner	Art Unit
	Phillip A Johnston	2881

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☐ Responsive to communication(s) filed on _____ .

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) 15-31 is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☐ Claim(s) 15-31 is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on 3/14/2001 is/are: a)☐ accepted or b)☒ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

11)☐ The proposed drawing correction filed on _____ is: a)☐ approved b)☐ disapproved by the Examiner.

If approved, corrected drawings are required in reply to this Office action.

12)☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

13)☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☒ All b)☐ Some * c)☐ None of:

1.☒ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____ .

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

14)☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).

a) ☐ The translation of the foreign language provisional application has been received.

15)☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☒ Information Disclosure Statement(s) (PTO-1449) Paper No(s) 6,8 .
4) ☐ Interview Summary (PTO-413) Paper No(s). _____ .
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: .

Detailed Action

Drawings

1. The drawings are objected to as failing to comply with 37 CFR 1.84(p)(4) because in Figure 2., reference character "22" has been used to designate both "target structure distance" and "back-scattered electrons indicated by a dashed line". A proposed drawing correction or corrected drawings are required in reply to the Office action to avoid abandonment of the application. The objection to the drawings will not be held in abeyance.

Claims Rejection – 35 U.S.C. 103

2. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which the subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

3. Claims 15-31 are rejected under 35 U.S.C. 103(a) as being unpatentable over U.S. Patent Publication No. U.S. 2001/0010357 to Ose, in view of Frosien, U. S. Patent No. 6,407,387.

Regarding Claims 15-19, Ose, discloses a particle beam apparatus, an SEM, having secondary signal electrons 2, generated when the specimen 13 is irradiated with the primary electron beam 1. The secondary signal electrons 2 include secondary electrons and reflected electrons (backscattered electrons). The electric field created in a space between the objective 10 and the specimen 13 acts as an acceleration electric field on the secondary signal electrons 2. Therefore, the secondary signal electrons 2 are attracted to the electron beam-passing aperture of the objective 10. The secondary signal electrons 2 travel upward being subjected to the focusing action of the magnetic field of the objective 10. The secondary signal electrons having high energy collide against a conversion electrode 16, whereby secondary electrons 3 are emitted. A positive high voltage of about 10 kV is applied to a scintillator 17. The scintillator 17 attracts (deflects) the secondary electrons 3 (as recited in Claim 19), and emits light. A secondary electron detector, not shown, that detects secondary electrons, guides the light emitted by the scintillator 17 by a light guide to a photomultiplier, the photomultiplier converts the light into a corresponding electric signal, the electric signal is amplified and the amplified electric signal is used for the brightness modulation of a CRT. See page 2, paragraph 0026. It is implied herein that the conversion electrode of Ose is equivalent to the "target structure", as recited in Claim 15. Ose, also teaches that when using the SEM's image shifting mode, the secondary electrons 2 are caused to travel along a path extending apart from the optical path so that most of the secondary electrons fall in a region not including the central aperture of the conversion electrode 16 on the conversion electrode 16, to suppress off-axis aberration due to image shifting and to

improve secondary electron detecting efficiency through deflection of the secondary electrons via superposition of the deflecting electric field. It is also possible to prevent the secondary electrons from passing the central aperture of the conversion electrode 16 by disposing an energy filter 60 including a plurality of layers of meshes below the conversion electrode 16 with respect to the traveling direction of the primary electron beam, whereby energy discriminating ability is improved. See page 3, paragraphs 0029, 30 and 31. It is implied herein, that the use of meshes near the conversion electrode to improve discriminating ability of the detection system is equivalent to the use of a web as part of the target , as recited in Claim 16. Ose further discloses, that when there is not any retarding electric field or the retarding electric field is sufficiently small, only the reflected electrons pass the electron beam-passing aperture of the objective 10. The reflected electrons have high energy. Positions at which the reflected electrons fall on the conversion electrode 16 are dependent on angle at which the electrons are reflected by the specimen 13 and energy of the reflected electrons. Therefore, information represented by the selected reflected electrons can be obtained in a high sensitivity by disposing an aperture filter 62 below the conversion electrode 16, with respect to the traveling direction of the primary electron beam. When the reflected electrons reflected in a substantially perpendicular direction are selected, an image of high contrast of a specimen having a specific atomic number can be observed in a high resolution. Substantially the same effect can be expected by making only a part of the conversion electrode 16 emit secondary electrons instead of employing the aperture filter 62. In such a case, it is preferable to coat the conversion electrode 16 excluding a part of the

same with carbon that emit secondary electrons at a low efficiency. (as recited in Claim 17). See page 3, paragraphs 0032-33. It is well known in the art that placement of detection systems near and remote from the optical axis, as recited in Claim 18, can be used to separately detect backscattered and secondary electrons respectively in a particle beam apparatus.

Regarding Claims 20-26,28, 30 and 31. Ose, discloses a particle beam apparatus, an SEM, "scanning microscope", as recited in Claims 30 and 31, that has an optical system of a short overall length because only the deflector 20 needs to be disposed between the condenser lens 9 and the objective 10. The primary electron beam 1 is decelerated by a decelerating electric field created between the objective 10 and the specimen 13 by applying a negative retarding voltage 15 through a stage 14 to the specimen 13 and is collimated by the collimating action of the objective 10. The upper deflector 20 is a magnetic deflector and the lower deflector 30 is an electrostatic deflector. The upper deflector 20 may be an electrostatic deflector. Similarly, the lower deflector 30 may be a magnetic deflector. However, since only a narrow space is available in the vicinity of the objective 10, it is proper to use an electrostatic deflector as the lower deflector 30. See page 2, paragraph 0021 and 22. It is well known in the art that the quantity, location and geometry of the magnetic and electrostatic deflecting fields, as recited in Claims 21-23, are design choices dictated by the dimensions of the SEM as well as the deflection amounts and directions desired therein. In addition, it is well known in the art, that the "detection system being at positive potential with respect to said target structure", as recited in Claim 24; the "detection system includes an electrode", as recited in Claim 25;

and the "electrode comprises one of a grid electrode or a perforated diaphragm", as recited in Claim 26, are all design choices common to SEM detection systems which are dictated by the geometry, location and charge of the particles being detected. It is also well known in the art to utilize "electrostatic and magnetic fields that are settable independently of each other", as recited in Claim 28.

Regarding Claims 27 and 29, Ose, as applied to claims 15-26,28, 30 and 31, above, discloses an SEM particle beam apparatus that includes nearly all the limitations of Claims 27 and 29, but does not teach the use of a beam guiding tube for the particle beam apparatus. Frosien; however, discloses a particle beam apparatus, particularly suitable as a scanning electron microscope for low voltage applications. The source 1 comprises, for instance, an electron gun 1a, an extractor 1b and an anode 1c, the gun being preferably a thermal field effect emitter, a cold field emitter or a photo-cathode. The anode 1c also constitutes the accelerating means 7. The decelerating means 8, are constituted by an immersion lens within the focusing means 3. The immersion lens comprises at least two electrodes 3a, 3b, whereby the first electrode 3a in the direction of the primary particle beam has a higher potential than the second electrode 3b. The immersion lens generates a retarding field for the primary particle beam. The back-scattered and/or secondary electrons 6, released at the specimen 4; however, will be accelerated by the immersion lens. Consequently, these secondary electrons, after passing the immersion lens, will have approximately the same high energy as the primary particles, which makes it difficult to detect the secondary electrons. However, according to the Frosien invention there are provided first and second additional means

to decelerate and accelerate the primary particle beam in the region of the detecting means 5. Therefore, the detecting means 5 are arranged in a low energy zone. If the potential applied in the region of the detector corresponds to the potential applied at the specimen, the back-scattered and/or secondary electrons will be decelerated at the detecting means to their original energy distribution, which is, for instance, from 0 to 50 eV. Although the primary particles are also decelerated in the detector region, they still have an energy, which is a multiple of the energy of the secondary particles. Consequently it is very easy to separate the secondary particles from the primary particles for its detection thereof. An additional means 9 for decelerating the primary particle beam, which comprises a hole electrode 9a and the lower end of a liner tube 9b. The liner tube 9b may have a potential of for instance 8 kV and the hole electrode 9a has ground potential. The second additional means 10 for accelerating the primary particle beam and decelerating the secondary particles comprises a grid electrode 10a and the upper end of a liner tube 10b. The grid electrode 10a is, e.g. at ground potential while the liner tube 10b has the same potential as the liner tube 9b. Frosien further teaches that the first and second additional means for decelerating and accelerating the primary particle beam can be generated by any kind of deceleration and acceleration lenses. The simplest case is a two-electrode lens, which consists of concentric holes or which is formed by grid electrodes. Also combinations of hole electrodes and grid electrodes are efficient. Furthermore, all kinds of elements, which have a deceleration and acceleration effect, e.g. Einzel lenses can be used and integrated in the signal detection concept. See Column 2, line 48-67, and Column3, line

1-33. Therefore it would have been obvious to one having ordinary skill in the art at the time the invention was made to modify the apparatus of Ose, with the beam guiding tube apparatus of Frosien, to improve back-scattered and secondary electron detection efficiency by using the beam tube for further separating the secondary particles from the primary particles, leading to improved signal to noise of the detection system, thereby resulting in improved inspection of semiconductor wafers.

Conclusion

4. Any inquiry concerning this communication or earlier communications should be directed to Phillip Johnston whose telephone number is (703) 305-7022. The examiner can normally be reached on Monday-Friday from 8:00 am to 5:30 pm.

If attempts to reach the examiner by telephone are unsuccessful, the examiners supervisor John Lee can be reached at (703) 308-4116. The fax phone numbers are (703) 308-2864 and (703) 308-7721.

PJ
September 23, 2002

JOHN R. LEE
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